Assessing the performance of ITS in major cities

Andrea Ricci, ISIS,email: aricci@isis-it.com
Suzanne Hoadley, Polis, email: shoadley@polis-online.org
Maurizio Tomassini, ISIS, email: mtomassini@isis-it.com
Ioannis Kaparias, Imperial College London, email: ioannis.kaparias@imperial.ac.uk
Konstantinos Zavitsas, Imperial College London, email : konstantinos.zavitsas01@imperial.ac.uk,

ABSTRACT

This paper introduces an EU project, called CONDUITS, which reviews ITS in cities today, provides an outlook on ITS developments tomorrow and establishes a set of key performance indicators (KPI). The KPI system to be developed is meant to comprehensively reflect a cities transportation situation. Therefore concepts to quantify improvements in traffic efficiency, traffic safety, environmental aspects as well as land use and the integration of disadvantaged population groups through ITS investments are considered. The robustness and usefulness of the KPI system will be tested through case studies in Paris and Rome.
The project consortium (listed at the end of this paper) consists of 9 European partners (five major European cities, two universities, an SME and a European networking organisation) and an Israeli technical centre.
CONDUITS stands for Coordination Of Network Descriptors for Urban Intelligent Transportation Systems.

FULL PAPER

A. ITS today

Intelligent Transportation Systems (ITS) are increasingly being deployed in urban areas as part of the response to the transport issues they face. The services offered range from traffic control through public transport information to travel demand management. However, as each urban area tends to be autonomous and act in response to its own political pressures it is very difficult to build a picture across Europe and beyond of how ITS are being used to provide solutions, the scale of deployment and the comparative effectiveness of that deployment. It is important to have this wide picture because it can inform where future investment is needed in research, training and deployment. This information can show where the market is effective, where barriers need to be removed and where the effectiveness of investment can be improved.

B. The need for tools to support ITS decision making

Recent discussions between professional officers in a number of cities have shown that there is no coherent data source summarising the ITS features implemented in European cities in order

to manage traffic demand. There is a wide range of issues and a similar wide range of approaches to tackle transportation problems in European cities. There are several data sources containing some data but these do not provide sufficient structure to give a clear picture. Furthermore, there is no framework to evaluate whether particular ITS implementations constitute best practice considering the specific city context.

A comparison of the impact of ITS strategies is further timely as the European Commission proposed in December 2008 an ITS Action Plan and accompanying directive to support the deployment of ITS (Communication from the Commission: Action Plan for the Deployment of Intelligent Transport Systems in Europe - COM(2008)886) and has also set ITS as a priority area to be implemented in developing urban transport systems (Action Plan on Urban Mobility, September 2009, COM*).* Several European cities have set out ambitious visionary strategic transport plans or are in the process of doing so. ITS applications that provide intelligent mobility systems and interfaces between different transport modes are key elements in delivering the overall strategy. Learning from best practice in other cities is therefore a key in order to avoid costly mistakes.

Against this backdrop, a number of cities that are members of the Polis network came together to build a proposal for an EU project, called CONDUITS which commenced in May 2009.

C. Towards the quantification of ITS impacts

The main research activities of CONDUITS are split into three areas:

(1) The first area (*see chapter E for preliminary results*) is set out to provide an in-depth review of current transportation problems and ITS solutions in European cities. ITS deployment varies from city to city and the purpose therefore is to understand the city context that led decision makers to prioritise these investments and the extent to which these investment decisions have been demand and/or politically driven. This analysis is based on in-depth information provided by the 5 city partners (Paris, Brussels, Rome, Barcelona and Istanbul) as well as data gathered through a survey of approximately 40 cities worldwide (making up the CONDUITS city pool). This exercise is expected to lead to a;

   a. Detailed description of the main ITS applications deployed in partner cities with a focus on those facilitating multi-modal journeys
   b. Understanding of why a particular ITS application was implemented, whether performance has met expectations and any implementation problems
   c. Comparison of ITS deployment and performance in partner cities with leading ITS cities worldwide - which systems are not deployed in Europe and why?

(2) The second area is a logical continuation of the first as it looks into the future ITS situation in European cities and beyond and compares this to technological developments. An analysis of transport vision documents and implementation plans should point out the commonalities in the vision of different cities in Europe and link this back to the city context data collected in the previous task. A review of recent technological research and development should identify the technologies that are ready for implementation in the next decade. Together, these should lead to the definition of ITS R&D needs for cities.

(3) Building on the findings of the first two areas, the third area, and main focus of CONDUITS, will develop a tool to enable quantification of the benefits achieved through ITS in terms of:

   a. traffic efficiency, eg, modal split, network delay and travel time reliability),

b. traffic safety (accident & casualty numbers, traffic flow, lane changes, rescue & warning management),

c. environmental aspects, eg, traffic volume, local vehicle fleet composition, average speeds

d. in-direct impacts such as those on land-use and social integration, eg, accessibility of ITS to all, ease of use (intuitiveness), urban sprawl, commuter traffic (by mode and in terms of origin & destination).

This will lead to the definition of a set of key performance indicators which will be applied to three partner cities:

– Rome: Mobility Control Centre (upgrading & provision of new services to users with environment as focus)
– Paris: Bus priority system (quantifying benefits of future expansion/investments)
– Barcelona: Traffic signal upgrading

D. Expected outputs

- **the establishment of a coherent set of performance indicators to indicate ITS good practice**

These indicators are designed to help to understand in which areas the transport network of a city is performing well. Indicators should include all areas in which ITS applications can improve performance. Hence safety, efficiency of individual modes, sustainable transport as well as environmental issues are all addressed. ITS can further bring improvements in providing transport for disadvantaged population groups (disadvantaged by location, disabilities or poverty) so that the indicators should show whether recent investments in the transportation network have brought improvements in these areas. The set of indicators will be useful for transport planners and engineer to make business cases for future ITS investments.

- **An understanding of European cities future ITS plans comparison with ITS worldwide**

To inform the on-going discussion in several European cities on what are realistic goals regarding the transport situation in the next decades, a comparison of the current state-of-the-art with statements of intent issued by the Local Authorities would be informative. It will help transport policy formation in European cities to understand where they stand in comparison to other cities worldwide, and it will help to set intermediate goals. It will further help politicians as well as transport engineers to build the case for investment in appropriate urban ITS systems. A key theme in European transport policy is integrated mobility. It is the aim of this project to inform in how far this reflected in the investment plans of European cities.

- **A clarification of the market for specific ITS applications and understanding of the barriers to implementation**

Establishing performance indicators further helps identifying possible markets for ITS applications. For example showing that the recent investments in new traffic management and control systems in Tel Aviv or Berlin have led to significant improvements could stimulate interest in several other cities. For large scale investments like these, understanding the city context is crucial. The project looks at the potential for implementing recent technological advances through targeted case studies that are of interest to the city partners. Based on

findings from a recent city comparison project funded by TfL possible topics for case studies of interest to all city partners would include the potential for:

- Designing a decision support system: Reaction to unforeseen events, information dissemination to the public, development of action plans.
- Data Framework and ITS Architecture: In particular the combination of different data sources.
- Effective presentation of travel conditions to the public: Web site design, choice of what information to present, usefulness of call centres.

The project further intends to establish a basis to understand the interest of cities in innovative ITS research ideas. For example the project aims at setting up a framework for an informed discussion with several cities regarding future priorities for innovations in traffic signal control having understood the particular context these cities are operating under.

- **A structured technical exchange on ITS solutions applied in major European cities**

Various initiatives, conferences and workshops exist that facilitate the exchange of ITS ideas. However, in-depth exchange of technical knowledge between engineers of major metropolitan cities is still limited. In particular the increasing speed of investments in advanced (and expensive) ITS architecture and in particular "integrated traffic control centres" requires a better exchange of experiences between the operators of such schemes. The project will facilitate such an exchange through a serious of workshops and possibly the establishment of a city club specifically to promote best practice.

E. CONDUITS preliminary results - Survey of ITS in European cities today

The objective of this study was, as a first step, to understand the city context and set out the background for a review of ITS in cities in Europe and worldwide, and as a second step, to establish the current status of traffic management and ITS in Europe and beyond. To identify the major transport problems that cities are faced with, primary and secondary research was carried out. With respect to the latter, a thorough literature review on transport problems in cities has been conducted, including a review of measures, policies and technologies that have been implemented worldwide. To complement this, however, primary research has been undertaken, whereby representatives from 16 cities[1] have taken part in two focus groups during the 1st CONDUITS Technical workshop (Rome, 6-7 May 2010). The aim of the first focus group was to ask each city representative directly about the needs and priorities of his/her city, about the main transport problems and about the role that ITS plays or can play in resolving these problems. The cities' representatives were also encouraged to engage in a discussion between themselves so as to identify the main common challenges.

Summarising the results, the importance of efficient urban transport has been highlighted, among others due to its close relationship with economic prosperity and development. However, providing efficient transport is associated with dealing with a number of problems, which have been categorised in five broad areas: *land use*, *congestion*, *car dependence*, *environment* and *safety*. Most cities have taken or plan to take action to address these problem

[1] Athens (Greece), Barcelona (Spain), Brussels (Belgium), Dublin (Ireland), Haifa (Israel), Istanbul (Turkey), Kocaeli (Turkey), London (UK), Rome (Italy), Sheffield (UK), Stockholm (Sweden), Stuttgart (Germany), Tel Aviv (Israel), The Hague (The Netherlands), Turin (Italy) and Zurich (Switzerland).

areas in order to achieve their short- and long-term objectives, which include changing the modal split in favour of public transport and soft modes, reducing emissions, decreasing road accidents, etc. An important additional issue that was identified is the fact that city transport authorities are very often confronted by political difficulties, difficulties in communication between organisations, and difficulties in sharing information.

ITS seem to play an important role in urban traffic management, as cities place them fairly high in their priorities. They are generally considered as offering potential solutions to many of the cities' problems, with the vast majority of the cities having implemented ITS technologies in terms of providing information to the public and facilitating traffic management, or planning to do so in the coming years. Cities see great potential in a set of Key Performance Indicators (KPIs), which would evaluate and assess traffic management policies and ITS.

With respect to the second part of the study, which was concerned with establishing the state-of-the-art in traffic management and ITS in cities in Europe and beyond, the methodology used involved the development of a questionnaire with the aim of collecting city-specific data for the analysis and to create an extended database on the traffic management policies and technologies implemented. The questionnaire covered several areas of traffic management, such as: general statistics of the transport systems, organisational structures, monitoring and forecasting, provision of traffic information and urban traffic control. Special focus was given to demand management, traffic control centres, public transport and parking. Cities were also given the opportunity to describe in more detail a specific policy or technology that they wished to demonstrate, as well as to state any other aspect of their traffic management strategy not covered by the questionnaire.

The questionnaire was circulated to many city authorities and the overall response was the following: 37 cities completed the questionnaire[2], of which 32 were European cities and 5 outside Europe (4 from Asia and one from South America). The data collected was analysed and tabulated for comparison purposes. Broadly summarising the results, it was found that strategic plans and traffic control centres are generally present in the cities that participated, as well as facilities for public transport, ITS technologies and real-time public transport information (in 31 cities). In addition, most cities have cycling infrastructure, pedestrian zones and alternative mobility schemes, as well as good policies for weaker population categories like the elderly, the jobless and the disabled (in 32 cities). The information obtained gives a fairly good overview of the situation in Europe and forms a very good dataset to be used for the application of the KPIs to be developed.

F. The CONDUITS partners

Institute of Studies for the Integration of Systems (ISIS) ***Coordinator***
Imperial College London (Imperial)
Technical University of Munich/Technische Universität München (TUM)
Israel Institute of Technology (Technion)

[2] Ankara (Turkey), Athens (Greece), Barcelona (Spain), Belo Horizonte (Brazil), Berlin (Germany), Bologna (Italy), Brescia (Italy), Brussels (Belgium), Bursa (Turkey), Edinburgh (UK), Frankfurt (Germany), Funchal (Portugal), Haifa (Israel), Hong Kong (PR China), Istanbul (Turkey), Kaohsiung (Taiwan), Karlsruhe (Germany), Kayseri (Turkey), Kocaeli (Turkey), London (UK), Milan (Italy), Munich (Germany), Prague (Czech Republic), Rome (Italy), Sheffield (UK), Southampton (UK), Stockholm (Sweden), Stuttgart (Germany), Taipei (Taiwan), Tel Aviv (Israel), Tokyo (Japan), The Hague (The Netherlands), Thessaloniki (Greece), Trondheim (Norway), Turin (Italy), Vienna (Austria), Zurich (Switzerland).

ATAC, Rome Mobility Agency (ATAC)
City of Paris - Department of roads and transportation (Paris)
Istanbul Metropolitan Municipality - Department of Transportation (Istanbul)
Administration de l'Equipement et des Déplacements/AED (Brussels Capital Region)
City of Barcelona
Promotion of Operational Links with Integrated Services aisbl (Polis)

G. The CONDUITS methodological framework